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1	Claims							
2								
3	 Apparatus for generating a mist comprising: 							
4	a conduit having a mixing chamber and an exit;							
5	a transport nozzle in fluid communication with							
6	the said conduit, the transport nozzle being adapted							
7	to introduce a transport fluid into the mixing							
8	chamber;							
9	a working nozzle positioned adjacent the							
10	transport nozzle intermediate the transport nozzle							
11	and the exit, the working nozzle being adapted to							
12	introduce a working fluid into the mixing chamber;							
13	characterised in that the transport nozzle							
14	includes a convergent-divergent portion therein such							
15	as in use to provide for the generation of high							
16	velocity flow of the transport fluid;							
17	and wherein the transport and working nozzles							
18	have a relative angular orientation such that in use							
19	the working fluid is atomised and a dispersed							
20	droplet flow regime of droplets having a							
21	substantially uniform size is created in the mixing							
22	chamber by the introduction of transport fluid flow							
23	from the transport nozzle into working fluid flow							
24	from the working nozzle and the subsequent shearing							
25	of the working fluid by the transport fluid.							
26	• == == = = = = •							
27	2. The apparatus of claim 1, wherein the transport							

27 and/or working nozzle substantially circumscribes 28 29 the conduit.

30

31 The apparatus of claim 1 or 2, wherein the angular orientation and internal geometry of the 32

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transport and working nozzles is such that the size

2 of the working fluid droplets is less than 50μm.

3

- 4 4. The apparatus of any preceding claim, wherein
- 5 the mixing chamber includes a converging portion.

б

- 7 5. The apparatus of any of claims 1 to 3, wherein
- 8 the mixing chamber includes a diverging portion.

9

- 10 6. The apparatus of any preceding claim, wherein
- 11 the apparatus includes a second transport nozzle
- being adapted to introduce further transport fluid
- or a second transport fluid into the mixing chamber.

14

- 15 7. The apparatus of claim 7, wherein the second
- 16 transport nozzle is positioned nearer to the exit
- 17 than the working nozzle, such that the working
- nozzle is intermediate both transport nozzles.

19

- 20 8. The apparatus of any preceding claim, wherein
- 21 the mixing chamber includes an inlet adapted to
- 22 introduce an inlet fluid into the mixing chamber,
- 23 the inlet being distal from the exit, the transport
- 24 and working nozzles being arranged intermediate the
- 25 inlet and exit.

26

- The apparatus of any preceding claim, wherein
- 28 the apparatus includes a supplementary nozzle
- 29 arranged inside the transport nozzle and adapted to
- 30 introduce further transport fluid or a second
- 31 transport fluid into the mixing chamber.

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- 1 10. The apparatus of claim 9, wherein the
- 2 supplementary nozzle is arranged axially in the
- 3 mixing chamber.

4

- 5 11. The apparatus of claim 9 or 10, wherein the
- 6 supplementary nozzle extends forward of the
- 7 transport nozzle.

8

- 9 12. The apparatus of any of claims 9 to 11, wherein
- 10 the supplementary nozzle is shaped with a
- 11 convergent-divergent profile to provide supersonic
- 12 flow of the transport fluid which flows
- 13 therethrough.

14

- 15 13. The apparatus of any preceding claim, wherein
- 16 the transport nozzle is shaped such that the
- 17 transport fluid introduced into the mixing chamber
- 18 through the transport nozzle has a divergent or
- 19 convergent flow pattern.

20

- 21 14. The apparatus of claim 13, wherein the
- 22 transport nozzle has inner and outer surfaces each
- 23 being substantially frustoconical in shape.

24

- 25 15. The apparatus of any preceding claim, wherein
- 26 the working nozzle is shaped such that working fluid
- 27 introduced into the mixing chamber through the
- working nozzle has a convergent or divergent flow
- 29 pattern.

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- 1 The apparatus of claim 15, wherein the working
- nozzle has inner and outer surfaces each being 2
- substantially frustoconical in shape. 3

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- 5 The apparatus of any preceding claim, further
- including control means adapted to control one or 6
- more of droplet size, droplet distribution, spray 7
- cone angle and projection distance. 8

9

- The apparatus of any preceding claim, further 10
- including control means to control one or more of 11
- the flow rate, pressure, velocity, quality, and 12
- temperature of the working or transport fluids. 13

14

- 15 The apparatus of claim 17 or claim 18, wherein
- the control means includes means to control the 16
- angular orientation and internal geometry of the 17
- transport and working nozzles. 18

19

- 20 The apparatus of any of claims 17 to 19,
- wherein the control means includes means to control 21.
- the internal geometry of at least part of the mixing 22
- chamber or exit to vary it between convergent and 23
- 24 divergent.

25.

- 26 The apparatus of any preceding claim, wherein 21.
- the internal geometry of the transport nozzles has 27
- an area ratio, namely exit area to throat area, in 28
- the range 1.75 to 15, having an included angle lpha29
- substantially equal to or less than 6 degrees for 30
- supersonic flow and substantially equal to or less 31
- than 12 degrees for sub-sonic flow. 32

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- 2 The apparatus of any preceding claim, wherein
- the transport nozzle is oriented at an angle β of 3
- between 0 to 30 degrees. 4

- The apparatus of any preceding claim, wherein б 23.
- the mixing chamber is closed upstream of the 7
- 8 transport nozzle.

9

- 10 The apparatus of any preceding claim, wherein
- the exit of the apparatus is provided with a cowl to 11
- 12 control the mist.

13

- 14 The apparatus of claim 24, wherein the cowl
- comprises a plurality of separate sections arranged 15
- radially, each section adapted to control and re-16
- direct a portion of the discharge of mist emerging 17
- 18 from the exit.

19

- The apparatus of any preceding claim, wherein 20
- the apparatus for generating a mist is located 21
- 22 within a further cowl.

23

- The apparatus of any preceding claim, wherein 24 27.
- the conduit includes a passage. 25

- 27 The apparatus of any preceding claim, wherein 28.
- at least one of the passage, the transport 28
- nozzle(s), working nozzle(s) and secondary nozzle(s) 29
- 30 has a turbulator to induce turbulence of the fluid
- therethrough prior to the fluid being introduced 31
- into the mixing chamber. 32

28 29

30

31

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1								
2	29. A spray system comprising apparatus of any of							
3	claims 1 to 28 and transport fluid in the form of							
4	steam.							
5								
6	30. The spray system of claim 29, further including							
7	working fluid in the form of water.							
8	water.							
9	31. The spray system of claim 29 or 30, further							
10	including a steam generator and water supply.							
11	supply.							
12	32. The spray system of claim 31, wherein the spray							
13	system is portable.							
14								
15	33. A method of generating a mist comprising the							
16	steps of:							
17	introducing a flow of transport fluid into a							
18	mixing chamber through a transport nozzle;							
19.	introducing a flow of working fluid into the							
20	mixing chamber through a working nozzle located							
21	downstream of the transport nozzle;							
22	generating a high velocity flow of the							
23	transport fluid by way of a convergent-divergent							
24	portion within the transport nozzle;							
25	orienting the transport and working nozzles							
26	such that the high velocity transport fluid flow							
27	imparts a shearing force on the working fluid flow;							
28	and							
29	atomising the working fluid and creating a							
30	dispersed droplet flow regime of droplets having a							
21	and a second and a second and a second as							

of the working fluid on the transport fluid.

substantially uniform size under the shearing action

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- 2 34. The method of claim 33, wherein the apparatus
- 3 is an apparatus according to any of claims 1 to 32.

4

- 5 35. The method of claim 33 or 34, wherein the
- 6 stream of transport fluid introduced into the mixing
- 7 chamber is annular.

8

- 9 36. The method of any of claims 33 to 35, wherein
- 10 the working fluid droplets have a size less than
- 11 50μm.

12

- 13 37. The method of any of claims 33 to 36, wherein
- 14 the method includes the step of introducing the
- transport fluid into the mixing chamber in a
- 16 continuous or discontinuous or intermittent or
- 17 pulsed manner.

18

- 19 38. The method of any of claims 33 to 37, wherein
- 20 the method includes the step of introducing the
- 21 transport fluid into the mixing chamber as a
- 22 supersonic flow.

23

- 24 39. The method of any of claims 33 to 38, wherein
- 25 the method includes the step of introducing the
- 26 working fluid into the mixing chamber in a
- 27 continuous or discontinuous or intermittent or
- 28 pulsed manner.

- 30 40. The method of any of claims 33 to 39, wherein
- 31 the method includes the step of introducing the

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	<u>.</u>	transport	fluid	into	the	mixing	${\tt chamber}$	as	a	sub-
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sonic flow. 2

3

- The method of any of claims 33 to 40, wherein 4
- the mist is controlled by modulating at least one of 5
- the following parameters: 6
- the flow rate, pressure, velocity, quality
- and/or temperature of the transport fluid; 8
- the flow rate, pressure, velocity, quality 9
- and/or temperature of the working fluid; 10
- the flow rate, pressure, velocity, quality 11
- and/or temperature of the inlet fluid; 12
- 13 the angular orientation of the transport and/or
- working and/or secondary nozzle(s) of the apparatus; 14
- the internal geometry of the transport and/or 15
- working and/or secondary nozzle(s) of the apparatus; 16
- 17 and
- 18 the internal geometry, length and/or cross
- section of the mixing chamber. 19

20

- The method of any of claims 33 to 41, including 21
- mixing the transport and working fluid together by 22
- means of a high velocity transport fluid jet issuing 23
- from the transport nozzle. 24

25

- The method of any of claims 33 to 42, including 26 43.
- the generation of condensation shocks and/or 27
- momentum transfer to provide suction within the 28
- 29 apparatus.

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- 1 44. The method of any of claims 33 to 43, including
- 2 inducing turbulence of the inlet fluid prior to it
- 3 being introduced into the mixing chamber.

4

- 5 45. The method of any of claims 33 to 44, including
- 6 inducing turbulence of the working fluid prior to it
- 7 being introduced into the mixing chamber.

8

- 9 46. The method of any of claims 33 to 45 including
- inducing turbulence of the transport fluid prior to
- it being introduced into the mixing chamber.

12

- 13 47. The method of any of claims 33 to 46, wherein
- 14 the transport fluid is steam or an air/steam
- 15 mixture.

16

- 17 48. The method of any of claims 33 to 47, wherein
- 18 the working fluid is water or a water-based liquid.

19

- 20 49. The method of any of claims 33 to 48, wherein
- 21 the mist is used for fire suppression.

22

- 23 50. The method of any of claims 33 to 49, wherein
- 24 the mist is used for decontamination.

- 26 51. The method of any of claims 33 to 50, wherein
- 27 the mist is used for gas scrubbing.